CLAIMS

What is claimed is:

1. A powertrain system, comprising:

a prime mover;

a change-gear transmission including an input, at least two gear ratios, and an output; and

a power shunt configured to route power applied to the transmission by one of the input and the output to the other one of the input and the output.

2. The powertrain system of claim 1, wherein the power shunt includes a first motor-generator and a second motor-generator.

3. The powertrain system of claim 2, wherein the first motor-generator is connected to the input and the second motor-generator is connected to the output.

4. The powertrain system of claim 2, wherein the first motor-generator is driven by the prime mover.

5. The powertrain system of claim 2, wherein the first and second motor-generators are electric motor-generators.

6. The powertrain system of claim 2, wherein the first and second motor-generators are hydraulic motor-pumps.

7. The powertrain system of claim 2, wherein the first motor-generator is a generator and the second motor generator is a motor when driveline torque is positive.

8. The powertrain system of claim 2, wherein the first motor-generator is a motor and the second motor-generator is a generator when driveline torque is negative.

9. The powertrain system of claim 2, wherein the power shunt includes electric power generated by one of the first and second motor-generators.

10. The powertrain system of claim 2, wherein the power shunt includes fluid power generated by one of the first and second motor-generators.

11. The powertrain system of claim 1, wherein the input is an input shaft and the output is an output shaft.

12. The powertrain system of claim 1, wherein the power shunt includes an energy storage device.

13. The powertrain system of claim 12, wherein the energy storage device stores electric power or fluid power.

14. The powertrain system of claim 1, wherein the ratio gears are engaged by a clutch and the power shunt is configured to route power applied to the transmission by one of the input and the output to the other one of the input and the output such that power transmitted between a selected ratio gear and an engaging clutch significantly decreases or falls to zero.

15. The powertrain system of claim 1, wherein the ratio gears are engaged by a clutch and the power shunt is configured to route power applied to the transmission by one of the input and the output to the other one of the input and the output such that

the rotational speed of a ratio gear is substantially similar to the rotational speed of an engaging clutch during a gear ratio change.

16. A powertrain system, comprising:

a prime mover;

a change-gear transmission that includes an input, at least two gear ratios and an output;

a first motor-generator connected to the input and a second motor-generator connected to the output,

a first power path between the input and the output of the transmission, the first power path defined by the gear ratios of the transmission; and

a second power path between the input and the output of the transmission, the second power path defined by the first and second motor-generators.

17. The powertrain system of claim 16, wherein first and second motor-generators are configured to route power through the second power path such that the power applied to the input is substantially similar to the power applied to the output during a gear change event.

18. The powertrain system of claim 16, wherein the first motor-generator is a generator and the second motor-generator is a motor when driveline torque is positive.

19. The powertrain system of claim 16, wherein the first motor-generator is a motor and the second motor-generator is a generator when driveline torque is negative.

20. The powertrain system of claim 16, wherein the second power path includes electric power generated by one of the first and second motor-generators.

21. The powertrain system of claim 16, wherein the second power path includes fluid power generated by one of the first and second motor-generators.

22. The powertrain system of claim 16, wherein the first and second motor-generators are either a motor or a generator.

23. The powertrain system of claim 16, wherein the input is an input shaft and the output is an output shaft.

24. The powertrain system of claim 16, wherein the second power path includes an energy storage device.

25. The powertrain system of claim 24, wherein the energy storage device stores electric power or fluid power.

26. The powertrain system of claim 16, wherein the ratio gears are engaged by a clutch and the power shunt is configured to route power applied to the transmission by one of the input and the output to the other one of the input and the output such that power transmitted between a selected ratio gear and an engaging clutch significantly decreases or falls to zero.

27. The powertrain system of claim 16, wherein the ratio gears are engaged by a clutch and the power shunt is configured to route power through the second power path such that the rotational speed of a ratio gear is substantially similar to the rotational speed of an engaging clutch during a gear ratio change.

28. A transmission system, comprising:

a change-gear transmission including an input, at least two gear ratios, and an output; and

a power shunt configured to route power applied to the transmission by one of the input and the output to the other one of the input and the output.

29. The transmission system of claim 28, wherein power shunt includes a first motor-generator and a second motor-generator.

30. The transmission system of claim 29, wherein the first motor-generator is connected to the input and the second motor-generator is connected to the output.

31. The transmission system of claim 29, wherein the first and second motor-generators are electric motor-generators.

32. The transmission system of claim 29, wherein the first and second motor-generators are hydraulic motor-pumps.

33. The transmission system of claim 29, wherein the first motor-generator is a generator and the second motor-generator is a motor when driveline torque is positive.

34. The transmission system of claim 29, wherein the first motor-generator is a motor and the second motor-generator is a generator when driveline torque is negative.

35. The transmission system of claim 29, wherein the power shunt includes electric power generated by one of the first and second motor-generators.

36. The transmission system of claim 29, wherein the power shunt includes fluid power generated by one of the first and second motor-generators.

37. The transmission system of claim 29, wherein the input is an input shaft and the output is an output shaft.

38. The transmission system of claim 29, wherein the power shunt includes an energy storage device.

39. The transmission system of claim 38, wherein the energy storage device stores electric power or fluid power.

40. The transmission system of claim 28, wherein the ratio gears are engaged by a clutch and the power shunt is configured to route power applied to the transmission by one of the input and the output to the other one of the input and the output such that power transmitted between a selected ratio gear and an engaging clutch significantly decreases or falls to zero.

41. The transmission system of claim 28, wherein the ratio gears are engaged by a clutch and the power shunt is configured to route power applied to the transmission by one of the input and the output to the other one of the input and the output such that the rotational speed of a ratio gear is substantially similar to the rotational speed of an engaging clutch during a gear ratio change.

42. A method for operating of a transmission, comprising:

providing a change-gear transmission including an input, at least two gear ratios, and an output; and

shunting power applied to the transmission by one of the input and the output to the other one of the input and the output.

43. The method of claim 42, wherein shunting power applied to the transmission by one of the input and the output to the other one of the input and the output is further defined by shunting power from the input to the output when driveline torque is positive.

44. The method of claim 42, wherein shunting power applied to the transmission by one of the input and the output to the other one of the input and the output is further defined by shunting power from the output to the input when driveline torque is negative.

45. The method of claim 42, wherein shunting power applied to the transmission by one of the input and the output to the other one of the input and the output is further defined by shunting power such that power transmitted between a selected ratio gear and an engaging clutch significantly decreases or falls to zero.

46. The method of claim 42, wherein shunting power applied to the transmission by one of the input and the output to the other one of the input and the output is further defined by shunting power such that the rotational speed of a ratio gear is substantially similar to the rotational speed of an engaging clutch during a gear ratio change.

47. The method of claim 42, wherein shunting power applied to the transmission by one of the input and the output to the other one of the input and the output is further defined by diminishing or augmenting the power shunted between the input and the output of the transmission.

48. The method of claim 42, further including the steps of providing a prime mover and reducing the power output of the prime mover during the shunting of power from the input to the output.

49. A powertrain system, comprising:

a change-gear transmission including an input, at least two gear ratios, and an output;

a prime mover connected to the input and configured to apply power to the transmission; and

a motor-generator connected to the output and adapted to absorb or apply power to the output in conjunction with a corresponding increase or decrease, respectively, in the application of power by the prime mover to the transmission to facilitate a gear ratio change in the transmission.

50. The powertrain system of claim 49, wherein the powertrain system includes an energy storage device configured to store power received from the motor-generator when the motor-generator absorbs power from the output and further configured to provide power to the motor-generator when the motor-generator applies power to the output.